VI. Sampling

Sampling theorem
Sampling with a zero-order hold

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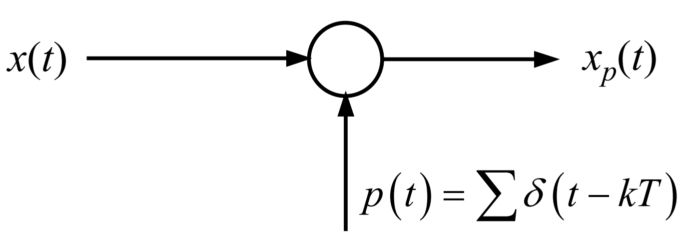
<u>Goal</u>:
- to process data numerically
- under certain conditions, a continuous signal can be represented by its samples

1) <u>Sampling Theorem</u>

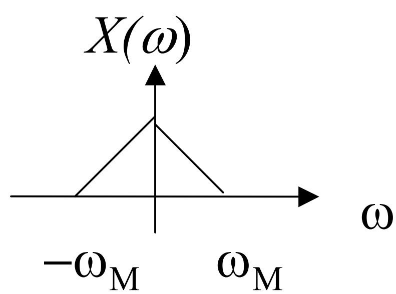


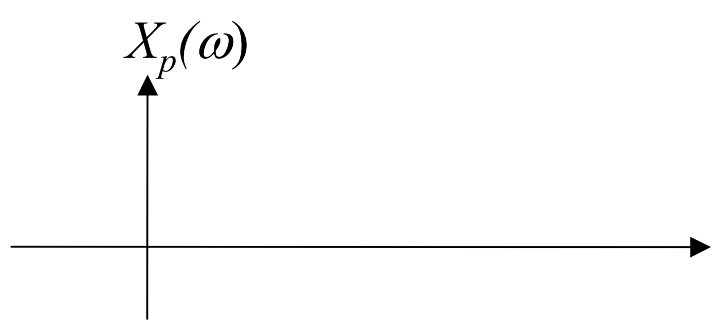
- <u>Spectrum of sampled signal</u>

Use modulation property:

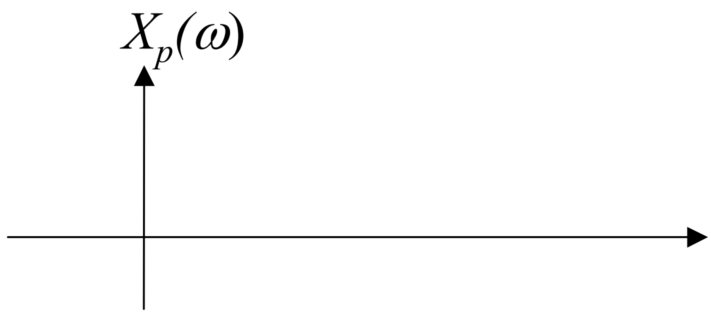
$$X_p(\omega) = \frac{1}{2\pi} X(\omega) * P(\omega) =$$

$$=$$

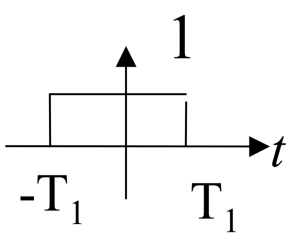




- How to get the original signal back ?

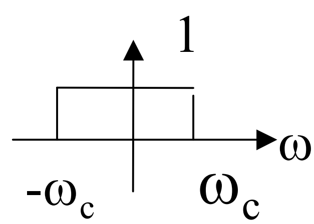


Recall:



$\Rightarrow$ $2T_1 \operatorname{sinc}(\omega T_1/\pi)$

$\sin(t\omega_c)/\pi t$ $\Rightarrow$



<u>Sampling theorem</u>:

When $x(t)$ is bandlimited with $X(\omega) = 0\ |\omega| > \omega_M$ then, $x(t)$ is uniquely determined by its samples

$x(nT)$ if: $\quad \omega_s > 2\omega_M\ , \quad \omega_s = \dfrac{2\pi}{T}$

$2\omega_M$: called the Nyquist rate

2) <u>Sampling with a Zero-Order Hold</u>

- Why a zero-order hold ?

- Consequences in the frequency domain